

REMARKS

The Office Action dated December 3, 2004, has been received and carefully noted. The amendments made herein and the following remarks are submitted as a full and complete response thereto.

Claims 5, 6, 9 and 13-18 are pending. Claims 5, 6, 13 and 15 are rejected. Claim 14 is objected to. Claims 9 and 16-18 have been withdrawn from consideration. Claim 5 is amended. No new matter is added.

Claims 5, 6, 13 and 15 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 3,994,732 to Kino ("Kino") in view of U.S. Patent No. 4,151,006 to De Graaff *et al.* ("De Graaff"). Applicants respectfully traverse the obviousness rejection.

The present invention is directed to a method for manufacturing a light-emitting device by allowing ZnO to grow epitaxially on a silicon substrate with good crystallinity. Generally, when ZnO is allowed to grow on a silicon substrate, radical oxygen produced by the ZnO fiercely reacts with silicon to make the surface amorphous, and as a result, a ZnO-based compound semiconductor having good crystallinity is not able to be obtained. Normally forming the nitrided silicon film by a CVD method makes the film amorphous, and thus, unable to allow a single crystal layer to grow epitaxially.

Consequently, the reason why the nitrided film is formed by nitridation processing in the present invention is to allow a crystal layer to epitaxially grow on the film while suppressing reactions with oxygen.

Kino discloses a method to form a ZnO layer by RF sputtering after silicon oxide

film is formed by the oxidation process or nitrided silicon film, etc., is formed by the CVD method on a surface after the N layer is allowed to epitaxially grow on a silicon substrate. However, this oxide film or nitrided film is formed to provide an insulation film. Kino does not teach or suggest allowing the ZnO layer to epitaxially grow on the film. In fact, Kino appears to teach away from the idea of epitaxial growth. Applicants note that Kino discloses that the oxide film is about 1000 Å thick. See, Kino, column 6, line 64. An oxide film or nitrided film of this thickness causes the surface to become amorphous, thereby making it impossible to allow the ZnO layer to epitaxially grow on it.

Regarding the present invention, when the nitridation processing time is extended, the surface becomes amorphous, which is not desirable. The thickness of nitrided film should not be not more than 10 nm (100 Å), and more suitably, not more than 5 nm. See, the specification, paragraph 0059.

Applicants submit that it is possible to allow the ZnO layer having a good crystallinity to epitaxially grow without impairing crystallinity and to prevent surface oxidation by forming nitrided film by heat treatment. However, if the nitrided film is formed by the CVD method, the surface becomes amorphous, and it is therefore unable to allow the ZnO layer to be epitaxially grown on the substrate.

Applicants further note that Kino does not disclose allowing the ZnO-based compound semiconductor layer to epitaxially grow. Moreover, Kino neither discloses nor suggests that the ZnO-based compound semiconductor layer is allowed to epitaxially grow in such a manner as to have both an n-type layer and a p-type layer, as required in

amended claim 5, as well as to form a light emitting layer.

Applicants further submit that De Graaff does not make up for the deficiencies of Kino. Applicants submit that neither Kino nor De Graaff teaches or suggests the claimed limitation of “growing epitaxially on said silicon nitride film a semiconductor layer lamination having at least an n-type layer and a p-type layer to form a light emitting layer **which is made of a ZnO-based compound semiconductor.**”

With respect to the objection to claim 14, Applicants submit that claim 14 depends on claim 5, which should now be in condition for allowance. Accordingly, Applicants submit that claim 14 is also in condition for allowance and the objection has been overcome.

For the foregoing reasons, Applicants have shown that the presently claimed invention is not rendered obvious by the cited references. Accordingly, Applicants request consideration and withdrawal of its obviousness rejection.

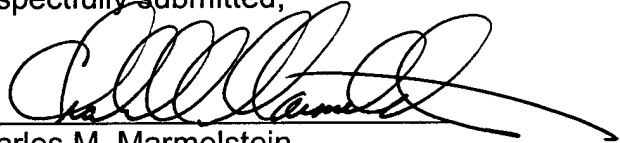
In view of the above, Applicants submit that claims 5, 6, 9 and 13-15 recite subject matter that is neither disclosed nor suggested in the cited prior art. Applicants also submit that the subject matter is more than sufficient to render the claims non-obvious to a person of ordinary skill in the art, and therefore respectfully request that the pending claims be found allowable and this application be passed to issue.

Additionally, Applicants note that the De Graaff reference cited in the Office Action of December 3, 2004, was not formally cited by the Office in PTO Form 892. Applicants respectfully request formal listing of the De Graaff reference by the Office.

If for any reason, the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact the Applicants' undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper has not been timely filed, the Applicants respectfully petition for an appropriate extension of time. Any fees for such an extension, together with any additional fees that may be due with respect to this paper, may be charged to counsel's Deposit Account No. 01-2300.

Respectfully submitted,



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